by which it becomes less responsive to germinative conditions. The following conditions caused the secondarily dormant seeds to germinate: removal or partial removal of the testa; redrying of the soaked seeds; short exposures to high or low temperatures; treatment with acids (especially n 0.01 HCl and propionic); treatment with high concentrations of carbon dioxide followed by germination in air. High partial pressures of oxygen had no effect on the germination of secondarily dormant seeds.

The authors give the following interpretation of this work: "It will be seen that the main interest of this communication centers around the causes underlying the initiation of growth rather than in the conditions of dormancy. In considering this question of growth in the case of seeds of *B. alba*, our experiments show clearly that there is no question of limiting factors. We have been able to trace no limiting factor responsible for the non-germination of white mustard seeds showing secondary dormancy. We find ourselves rather in the presence of facts which emphasize a conception of stimulus. It has been seen that widely different treatments, quite unclassifiable in any feature other than that they all result in injury and death, if carried too far, excite germination and growth of white mustard seed. It appears to us probable that some return will have to be made to this conception of stimulus in plant physiology generally, and that in any experimental analysis of the living plant, as a unit and in relation to its life-cycle, the idea of limiting factors, which has so long dominated the minds of plant physiologists, will have to be modified."—WM. CROCKER.

Chondriosomes in plants.—Investigations dealing with chondriosomes have become so numerous that it seems worth while to make a brief summary of the results obtained. As might be expected, a few structures of different nature have been called by the same name; but a host of names have been applied to the same structure, so that we have mitochondria, chondriosomes, chondriomites, chondriokonts, chromidia, sphaeroblasts, histomeres, plasmosomes, cytomicrosomes, etc. The "chondr," meaning a small grain, was chosen because most of the bodies are in the form of small granules; the "mito," meaning thread, is often suggestive, because the granules have a tendency to become arranged in rows. The terms mitochondria and chondriosomes will probably survive, and if a choice should be made between these two, it should be the latter, since it is noncommittal; while the fact that the threadlike arrangement is by no means universal is an objection to the term mitochondria. The name chromidia was applied because the writer believed that the granules were portions of the chromatin extruded from the nucleus. Such granules certainly occur in animals and possibly in plants, but they are not the same structures as the chondriosomes.

A historical résumé of the subject, with a very complete bibliography up to 1914, was compiled by CAVERS,[4] and in an investigation upon the rela-

[4] CAVERS, F., Chondriosomes (mitochondria) and their significance. New Phytol. **31**:170–180. 1914.

tion between chondriosomes and plastids, MOTTIER[5] has brought the literature up to 1918.

LA VALETTE ST. GEORGE, working upon the male cells of insects, gave the first description of chondriosomes. He introduced the term cytomicrosomes. MEVES, in 1904, gave the first description for plants, using the tapetal cells of anthers of *Nymphaea* for material. LEWITSKI, in 1910, was first to claim that chondriosomes give rise to plastids. A little later he made a comparative study upon living and fixed material, showing conclusively that the bodies are present in living cells. The investigation by MOTTIER, to which reference has already been made, proves that some chondriosomes give rise to chloroplasts and leucoplasts. He also believes that the chondriosomes are permanent organs of the cell, of equal rank with the nucleus. Of course he recognizes that chloroplasts and leucoplasts also multiply by division. His claim that chondriosomes are concerned in the transmission of hereditary characters does not seem to be so well supported. Some investigators have suggested that chondriosomes transmit characters of the cytoplasm and that the chromosomes transmit characters of the nucleus.

It seems to be established that chondriosomes are not artifacts, that they multiply by division, and that some of them give rise to plastids. Their rôle in heredity, if they have any, still remains to be demonstrated.—C. J. CHAMBERLAIN.

Trimorphism of Pontederia.—The family Pontederiaceae is notable as containing the only known heterostyled species among monocotyledons (with possibly one exception), and is further remarkable among heterostyled plants as furnishing the only recorded examples of distinctly zygomorphic flowers in such plants. HAZEN[6] has recently published interesting observations on *Pontederia cordata* L. LEGGETT had reported in 1875 that this species was trimorphic, and the present paper is a detailed study of the flower forms, pollination, insect visitors, etc.

The tubular perianth is slightly zygomorphic and in all 3 flower forms presents 2 sets of stamens: a longer set of 3 on the anterior side of the flower, and 3 short-stalked stamens on the posterior side of the flower. In 2 of the flowers the upper stamens protrude beyond the open perianth. The long-styled stigma reaches a height of 12–13.5 mm., the mid-styled form 7–8 mm., and the short-styled form 3–3.5 mm. above the base of the ovary. The ratios of the average heights of the 3 lengths of pistils are approximately as 100, 60, and 22.

While the arrangement of parts is different in each of the 3 flower forms, it results in 2 sets of stamens adjusted to each length of pistil. The 6 legitimate crosses which may take place between the 6 sets of stamens and the 3 different

[5] MOTTIER, D. M., Chondriosomes and the primordia of chloroplasts and leucoplasts. Ann. Botany **32**:191–214. *pl. 1.* 1918.

[6] HAZEN, TRACY E., The trimorphism and insect visitors of *Pontederia*. Mem. Torr. Bot. Club **17**:459–484. 1918.